

THE IMPORTANCE OF THERAPEUTIC FOOTWEAR

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Inappropriate or ill-fitting footwear is a major causative factor in the development of diabetic foot ulcers, particularly in individuals with sensory neuropathy. Footwear assessment and appropriate health promotion regarding suitable footwear should be an integral component of every management plan that aims to prevent diabetic foot ulceration.

Sensory loss is a major risk factor for diabetic foot ulceration (DFU); approximately 45–60% of all DFU are due to neuropathy (Frykberg et al, 2006). Sensory neuropathy results in loss of protective sensation which can subsequently lead to unnoticed trauma or injury to the foot from ill-fitting or inappropriate footwear. As part of any management plan that aims to prevent diabetic foot ulceration (DFU), facilitate healing of an active DFU or prevent recurrence of previous ulceration, footwear is a crucial consideration. It has long been recognised that inappropriate or ill-fitting footwear poses a significant risk factor for DFU, particularly in those with diabetes-related sensory neuropathy (International Working Group on the Diabetic Foot [IWG], 1999). Yet, as Tyrell and Carter (2008) suggest, footwear as a therapeutic strategy has largely been ignored or given low priority, which is somewhat reflected in the limited evidence base in this area.



Figure 1. Lateral heel flare.

Therapeutic footwear

Therapeutic footwear has been shown to have a beneficial effect in the primary and secondary prevention of DFU and to facilitate wound healing (Maciejewski et al, 2004). Furthermore, patients who routinely wear therapeutic

footwear and orthoses are less likely to develop ulcer recurrence (Scottish Intercollegiate Guidelines Network [SIGN], 2001). Indeed, Tyrell and Carter (2008) report the findings of a study that found that patients with diabetes who wore their therapeutic footwear for greater than 60% of the daytime reduced ulcer recurrence by more than 50%. Effective therapeutic footwear has many benefits for the individual, including improved mobility, comfort and protection, and an improved quality of life and sense of well-being (Tyrell and Carter, 2008). However, clinical-effectiveness is heavily dependent on acceptability and actual use of the therapeutic footwear (Boulton and Jude, 2004).

Patient-centred care and concordance

Tyrell and Carter (2008) highlighted the fact that dissatisfaction with the cosmetic appearance of therapeutic footwear is a constant theme

in the literature. Knowles and Boulton (1996) reported poor patient concordance with therapeutic footwear in a diabetic population with only 22% of patients admitting that they regularly wore the prescribed footwear. It is therefore important to implement a patient-centred approach when considering therapeutic footwear as a management strategy. A key aspect that must be addressed is the patient's choice of footwear, perceptions of footwear, and criteria that are significant to them. Without this there will be limited success in finding footwear to meet the needs of the patient in terms of acceptability and style (Tyrell and Carter, 2008). There is limited benefit in referring a patient for a footwear assessment, or prescribing therapeutic footwear if they will not be worn.

Assessment for therapeutic footwear

Individuals presenting with foot complications that are associated with diabetes require rapid access to specialist multidisciplinary diabetes teams to allow the team to undertake appropriate assessments and initiate timely management strategies. Podiatrists and orthotists as part of the specialist multidisciplinary team, will routinely assess the foot for the presence of deformities or structural anomalies, and assess the patient's need for therapeutic footwear.

The National Institute for Health and Clinical Excellence (NICE) (2004) guidelines advocate a classification system which

Table 1

Risk classification for the diabetic foot (NICE, 2004)

Risk 1 Low risk	<ul style="list-style-type: none"> » No increased risk of foot problems » No signs of neuropathy » No peripheral vascular disease » No foot deformity
Risk 2 Medium risk	<ul style="list-style-type: none"> » Peripheral vascular disease and/or peripheral polyneuropathy » Dry skin with hair loss » Impaired sensation » Foot deformities
Risk 3 High risk	<ul style="list-style-type: none"> » Peripheral polyneuropathy » Peripheral vascular disease » History of previous foot ulcers » Amputation and/or Charcot changes

categorises individuals as low, medium or high risk for the development of DFU (Table 1). This is a particularly useful tool for identifying those most in need of therapeutic footwear. For individuals considered to be at low risk, often health promotion advice regarding the purchase of appropriate footwear will suffice. However, it is important to identify individuals considered to be at medium to high risk of DFU and who would benefit from therapeutic footwear in order to prevent long-term foot complications.

Range and function of therapeutic footwear

Tyrell and Carter (2008) suggest that the range of therapeutic footwear has improved in recent years allowing more patient choice. Essentially they describe three different types of therapeutic footwear:

- » Stock orthopaedic — off the shelf
- » Modular orthopaedic — minor modifications to stock

orthopaedic shoes. Specific footwear modifications can be prescribed by the orthotist or podiatrist to prevent unwanted movements of the foot and ankle. For instance, a lateral flare can be added to the heel (Figure 1) to restrict certain movements of the foot

- » Bespoke-made specifically for the patient. Bespoke footwear is generally prescribed to individuals with unusual foot shapes/severe deformities.

Regardless of the range, therapeutic footwear should:

- » Protect the foot from injury to the skin that can result from the absence of protective sensation
- » Protect the foot from deformity (or from further deformity), particularly for those with Charcot changes (a progressive condition linked to diabetic neuropathy that can lead to severe foot deformities)
- » Protect the foot from external damage — toes must always be enclosed and the sole

should be firm enough to stop foreign bodies piercing it.

The overall mechanical function of therapeutic footwear is to reduce plantar pressure over at risk/vulnerable sites, or previously ulcerated sites on the foot by transferring the load across the foot. For instance, significant reductions in pressure over the forefoot can be achieved with shoes that have a modified sole known as rocker bottom sole (Figure 2) and with footwear that include orthoses (Figure 3) (Bus et al 2008).

Factors to be considered with therapeutic footwear

Length and depth

Therapeutic footwear should have an appropriate snug fitting, not being tight or overly loose. This snugness prevents movement within the shoe; movement of the foot during gait results in shear forces which are particularly damaging to the skin. The firm fit also distributes pressures over as wide an area as possible lowering specific points of pressure. Particularly important is the appropriate sizing of the shoe. The length of the foot should be measured in weight bearing (as the foot can elongate longitudinally in standing). The required depth of the toe box should be measured, and clawing or fanning of the digits in standing and walking should be noted so this can be accommodated adequately. Extra depth toe boxes, as illustrated in Figure 4, can be particularly beneficial for patients who have toe deformities. The overall depth should also be sufficient to accommodate orthoses if prescribed.

Width and circumference

An appropriate width and circumference across the forefoot is just as critical as an appropriate length of shoe. In the authors' experience it is common for clients with a wide measurement in this area to have moved towards larger sized footwear to accommodate width requirements.

Heel counter

An appropriate heel counter width is also important, as too much room in this area could cause friction on the skin as the foot moves within the shoe, while a too tight fit can lead to pressure in this area. The collar height should sit below the ankle malleoli. The collar should be softly padded to avoid rubbing on the skin around the ankle.

Deformities

Deformities must be accommodated within the footwear but also supported to prevent further progression. This support can take the form of foot orthoses or a more extensive device such as an AFO (ankle foot orthosis). Footwear modifications such as flares (Figure 1) can be employed to modify the forces acting on the foot. These modifications should be decided on by a podiatrist or orthotist.

Inside linings

The inside of the footwear should be soft throughout with the seams flat and sewn internally. This is of primary importance for patients with diabetes as prominent seams can cause damage to the skin. An important feature of a footwear review is simply



Figure 2. Therapeutic footwear with a rocker-bottom sole.



Figure 3. An example of an orthotic device.



Figure 4. Footwear with an extra depth toe box.

running the hand inside the shoe to feel for irregularities or damage, ensuring the linings are soft and uniform. Ridges, irregularities or wearing of the lining should be dealt with by repair or replacement, and any foreign bodies should be removed.

Finally, the closure of the shoe should be secure. If it becomes loose friction within the footwear is more likely which could give rise to tissue damage.

Regular inspection of footwear

Footwear should be assessed at each consultation to plan for repair or replacement. Regular review of footwear is important as footwear does deteriorate over time; the sole of the shoe can become worn, linings can

become less soft and smooth, and foreign bodies can enter footwear.

Examination of the shoe can also give an indication of abnormal wear patterns and the patient's level of activity. Wearing of the sole, especially the lateral heel introduces wedging (or tipping) of the foot. This should be repaired promptly; if this is left unchecked it can contribute to ankle sprains. If orthoses have been provided they should also be regularly checked by a podiatrist or orthotist.

The condition of the footwear can also reflect the general foot hygiene of the individual. Problems with hygiene can result from either functional inability to care for the feet or lack of understanding of its importance. It is important to involve the patient in this process to try to empower them to take personal responsibility for their own foot health and care of their footwear. *Table 2* provides a simple checklist that can be used when assessing footwear.

Conclusion

Effective therapeutic footwear can play a significant role in the prevention of DFU, particularly in patients with sensory neuropathy. Therapeutic footwear can have many positive effects. For the individual this can include better mobility and an improved quality of life and sense of well-being. However, the clinical-effectiveness of therapeutic footwear is dependent on acceptability by the patient and actual use of the footwear. The multidisciplinary team must adopt a patient-

centred approach towards therapeutic footwear to increase the likelihood of patient concordance. **WE**

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Table 2

Checklist for the assessment of footwear

Subjective feedback	Ask the client if the footwear is: <ul style="list-style-type: none"> » Comfortable » Being used » Easy to get on and off independently
Objective assessment of footwear	
Fitting	<ul style="list-style-type: none"> » Firm snug fit » Appropriate length (Note: foot elongates in standing) » Appropriate width » Accommodates any foot deformities » Fastenings are able to be donned firmly (firm fastenings prevent the foot sliding in the shoe)
	<ul style="list-style-type: none"> » Soft intact lining throughout with seams flat and hidden » Check for foreign bodies
General condition	<ul style="list-style-type: none"> » Check for wear of the sole, especially over the lateral heel as this introduces wedging (or tipping) of the foot » Check orthotic insoles being used (if provided) » Consider hygiene
Compliance	<ul style="list-style-type: none"> » Less than expected wearing is a sign of poor compliance » Check that orthotic Insoles are in place if provided
Protects feet	<ul style="list-style-type: none"> » Toes enclosed » Sole firm enough